ml/s or $A_{reg} \geq 0.5$ cm^2, but not by JET or PVF. Spearman's rank coefficient was significant comparing Q_{max} or A_{reg} and ANGIO, but not JET and ANGIO. Correlation between CD and Q_{max} or A_{reg} was poor.

Conclusion: Multiplane TEE allows categorical separation of ANGIO severity class; assessment based on the flow convergence concept appears superior to JET and PVF.

987-102 Proximal Flow Convergence Calculation of Forward Flow and Valve Area of Normal Mitral Prostheses: An Intraoperative Validation

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We have previously shown in vitro that the proximal flow convergence method (FC) can be used to calculate flow through larger orifices such as normal prosthetic heart valves. To validate FC clinically, we performed intraoperative transesophageal echocardiography on 22 patients (mean age 63 ± 8 yrs, 64% female) undergoing mitral valve replacement with St Jude valve (n = 17) or Carpentier-Edwards valve (n = 5). For St Jude prostheses, peak velocities and velocity integrals through the center (V_c and TVI_c, respectively) and side (V_s and TVI_s) orifices were interrogated separately with CW Doppler. As our in vitro model suggested about 80% of flow occurred through the side orifices, the corrected peak Velocity (V_o) is given by $V_o = 0.8V_s + 0.2V_c$ and the corrected velocity integral (TVI_o) by $TVI_o = 0.8TVI_s + 0.2\ TVI_c$. The flow rate (Q) was calculated by $Q = 2\pi r^2 V_a$ where V_a is the aliasing velocity. Q was multiplied by $V_o/(V_o\text{-}V_a)$, a previously validated factor, to account for flattening of isotachs near the prosthetic orifice. *Results:* Cardiac output (CO) calculated by $(Q_c * TVIo/V_o) * HR$ showed good correlation with thermodilution CO (Range 3.3–8.1 l/min, $y = 0.87x + 0.67$, $r = 0.9$, $p < 0.001$, $\Delta CO = -0.02 \pm 0.5$ l/min). Effective prosthetic orifice area (EOA) of St Jude valves, given by Q_c/V_o, correlated well with geometric orifice area (GOA) from the manufacturers ($r = 0.7$, $p = 0.002$, $y = 1.42x + 1.47$). However, calculated EOA is significantly smaller than the GOA ($\Delta MVA = -2.23 \pm 0.49$ cm^2, $p < 0.01$) *Conclusions:* The proximal flow convergence method can give reliable *in vivo* estimates of 1) forward flow through normal mitral prostheses and 2) EOA of St Jude valves. The EOA of St Jude valve in vivo is significantly smaller than its GOA.

987-103 Relationship of Mitral Regurgitant Orifice Area to Semiquantitative Indices of Regurgitant Severity: An Intraoperative Transesophageal Investigation

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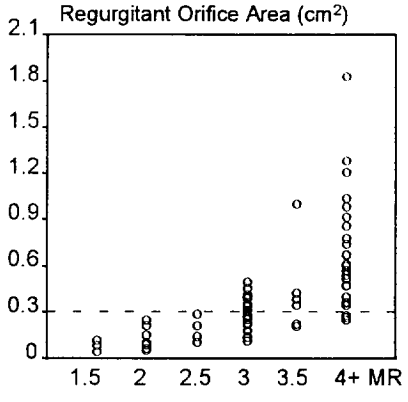
To better understand the relationship between quantitative measurements of mitral regurgitant orifice area (ROA) and traditional semiquantitative assessments based on color Doppler jet area, we studies 65 patients with mitral regurgitation (MR) using intraoperative transesophageal echocardiography. *Method:* MR was graded semiquantitatively on a 4 point scale, integrating information on jet size and morphology and pulmonary venous flow pattern. Blinded to the results of semiquantitative grading, ROA was measured as RSV $\int vdt$, where RSV was regurgitant stroke volume, calculated as the difference in forward stroke volume through the mitral annulus and that obtained from thermodilution, and v was the mitral regurgitant velocity obtained by continuous wave Doppler. *Results:* There was a significant difference of mean ROA between 2+ (0.18 ± 0.08 cm^2), 3+ (0.30 ± 0.11 cm^2) and 4+ MR (0.67 ± 0.36 cm^2 $p < 0.01$), with a significant correlation between ROA and MR grading throughout the patient population ($r = 0.79$ $p < 0.0001$). However, significant overlap was noted in patients graded in 2–3+ range (Fig.). Jet characteristics predictive of small ROA within a given grade was central directed jets. Optimal group separation was obtained as a ROA of 0.30 cm^2. *Conclusion:* 1) While useful as a rapid general classification of MR severity, semiquantitative Doppler methods have significant limitations for precise characterization of mitral incompetence; 2) ROA is readily obtained in the operating room and aids in quantitative assessment of MR.



987-104 Flexible Annuloplasty Support Preserves Physiological Annular Movement and Non-planar Shape: A 3-Dimensional Intraoperative Echocardiographic Study

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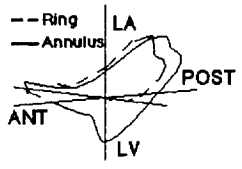
Mitral annular motion and nonplanar shape has been shown to be important to normal valve dynamics and left ventricular systolic function. We evaluated the effect of a new flexible annuloplasty ring on the morphology and motion of the mitral annulus in patients undergoing mitral repair.

Methods: the mitral valve was imaged over one complete cardiac cycle at ≈10° rotations using a multiplane transesophageal probe in 4 patients intraoperatively after mitral repair. Two had data pre and post repair for a total of 6 reconstructions. The data were digitized off-line and annular insertion points and ring location (post-op) were identified for each frame of data over the cardiac cycle (≈ 1000 points per reconstruction). The data were reconstructed in 3-D, and a least-square plane was fit. The following measures were obtained: A) annular area as projected onto the least-squares plane B) Atrio-ventricular motion of the annulus C) non-planarity of the annulus (mean-square-deviation from the least-squares fit plane). *Results:* All the patients maintained the non-planarity with a maximal deviation from the plane of 8.6 mm. The mean atrio-ventricular motion was 2.6 mm and the % change in area during the cardiac cycle was 14.7%. For the 2 patients with pre and post repair data, there was a reduction in total area of 59%, an increase of 18% in non-planarity and a reduction of maximal excursion of 47%. *Conclusion:* This preliminary study shows that annuloplasty repair with a flexible ring preserves annular motion and nonplanarity while allowing significant reduction in annular area.



987-105 Transesophageal Echocardiographic Quantitation of Systolic Mitral Leaflet Displacement in Patients with Mitral Valve Prolapse

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While *transesophageal* echocardiography (TEE) provides detailed structural information about the mitral valve, the range of normal systolic displacement of the mitral leaflets and the best criteria for diagnosing mitral valve prolapse (MVP) by this technique remain controversial. The area subtended by the systolic displacement of the mitral leaflets into the left atrium beyond the annular hinge points on 4 chamber and 2 chamber images of the mitral valve was measured by TEE in a blinded prospective study of 11 MVP pts (who had systolic displacement of the mitral leaflets superior to the mitral annular plane on parasternal long axis images by *transthoracic* echo and click and/or late systolic murmur on physical exam) and 11 NORMAL subjects (who had no evidence for MVP by either *transthoracic* echo or exam).

Area Subtended by Systolic Displacement of Mitral Leaflets (cm^2)

	4 Chamber View		2 Chamber View	
	AMV	PMV	AMV	PMV
MVP	0.82 ± 0.78	0.40 ± 0.43	1.01 ± 0.99	0.72 ± 0.76
NORMAL	0.03 ± 0.06**	0.00 ± 0.00**	0.18 ± 0.29*	0.03 ± 0.05**

**p < 0.01, *p < 0.02, A = anterior, P = posterior, MV = mitral valve

By TEE the area subtended by the superior displacement of the mitral leaflets into the left atrium was significantly greater for MVP pts than for NORMAL subjects. In NORMAL subjects superior displacement of the PMV was never detected in the 4 chamber view, but small degrees of superior displacement were occasionally detected in the 2 chamber view. As many as 6 of 11 NORMAL subjects exhibited minor degrees of superior displace-